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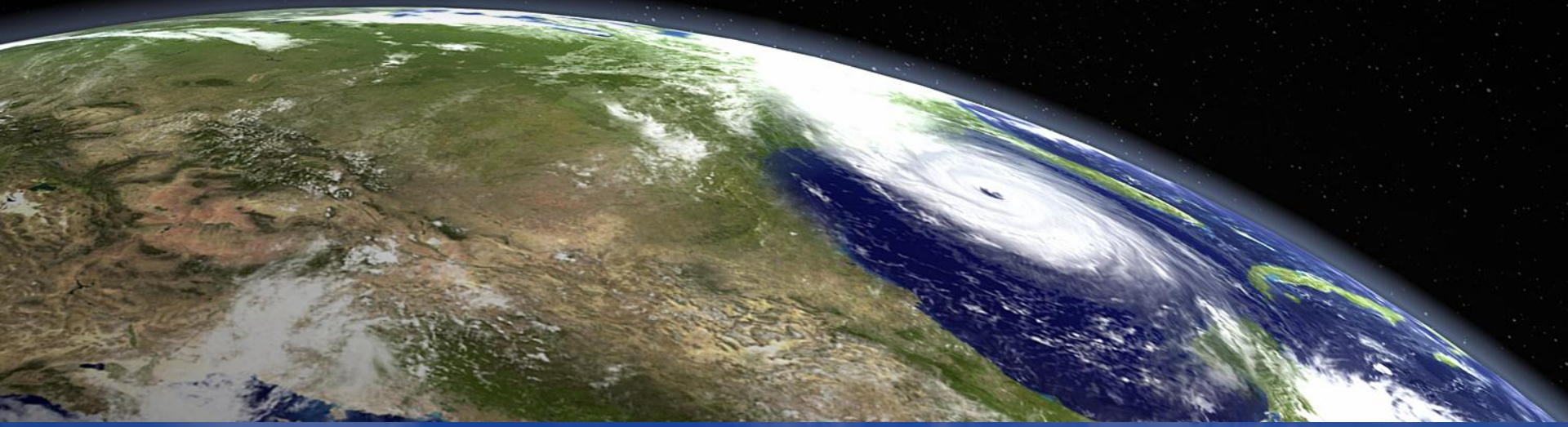
e5 by Earth Networks™

# e5 Centerpoint Energy Pilot Results

energy.efficiency.ease.environment.earth



Earth Networks℠

Taking the Pulse of the Planet℠

# World's Largest Weather Network

## Robust Global Network Infrastructure

## 5 Billion Connections Per Day

# The Evolution of the Thermostat




Thermostats are Next!

# Two 2012 e5 Texas DR Pilots

- **Centerpoint Energy**
  - 280 Radio Thermostat Customers
  - 9 DR Events over 17 Hours with 2.5 MW Shifted from Peak
  - 1.2 kW per Thermostat Average DR Capacity
  - 10 Opt-Outs
- **ERCOT ERS Program**
  - Over 500 Radio Thermostat Customers
  - ERCOT 30-Minute ERS Program
  - 8 DR Events
  - 9 Opt-outs

**Plus - e5 Can Save a Significant amount of Energy (13.8% on Average during the Cooling Season) with Little Impact to Consumer Comfort**

- 2X More Savings with e5 compared to Using Existing Average Set Backs

# How the Program Works

e5 Leverages the Consumer Trend toward Connected Thermostats to provide Demand Response to Utilities and Energy Efficiency for Consumers

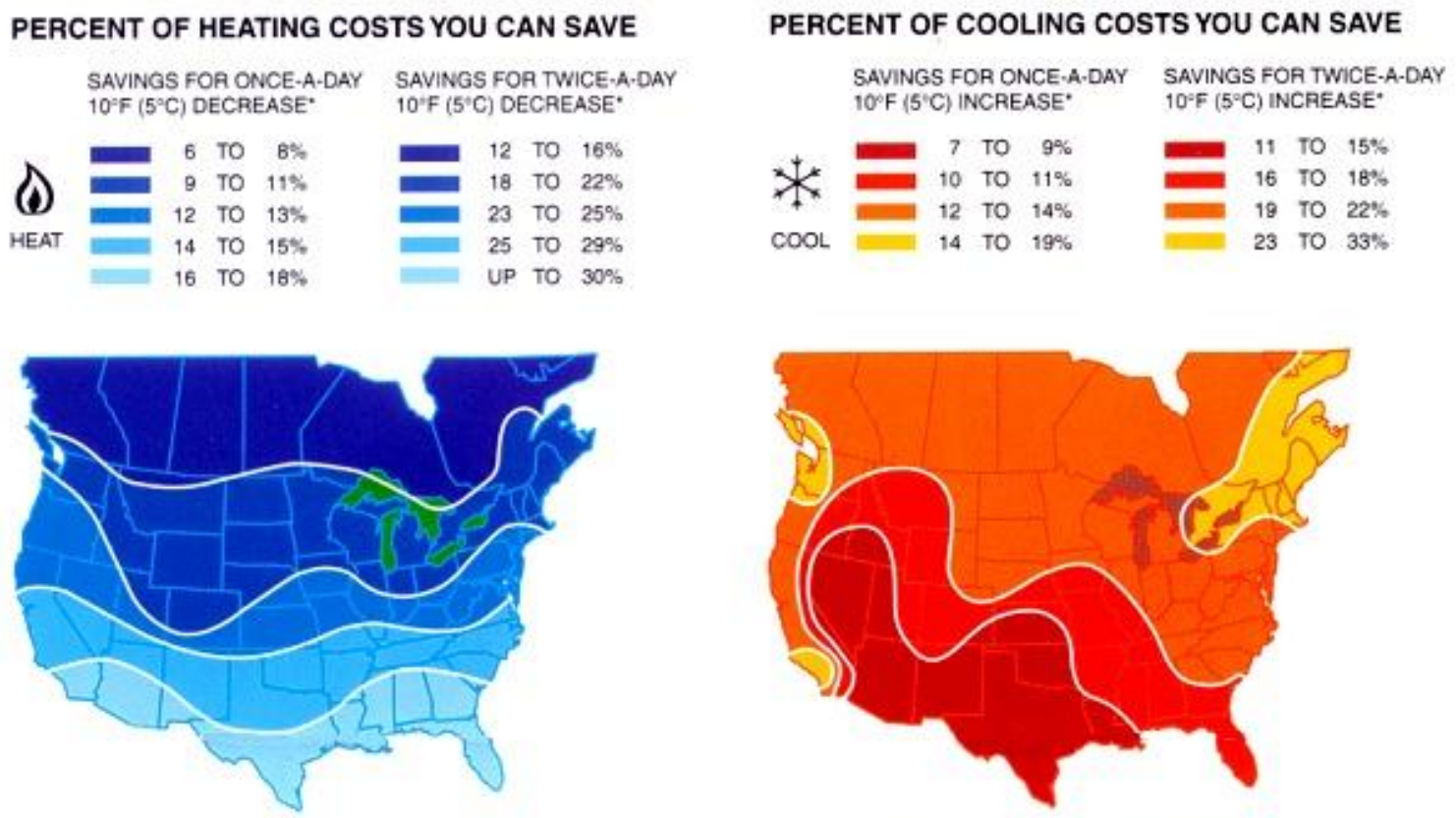
- **For the Utility**
  - No Thermostat Purchase, Install, or Support
  - Pay Only for Delivered Demand Response Capacity
  - Promoted by Thermostat Manufacturers, Service providers, and Across WeatherBug Properties
  - M&V via Smart Meter Data

- **For Consumers**
  - Thermostat Choice
  - Energy Efficiency
  - HVAC Scorecard
  - No Fees or Subscriptions
  - $25 Incentive for DR Participation

Radio Thermostat
Radio Thermostat Company of America

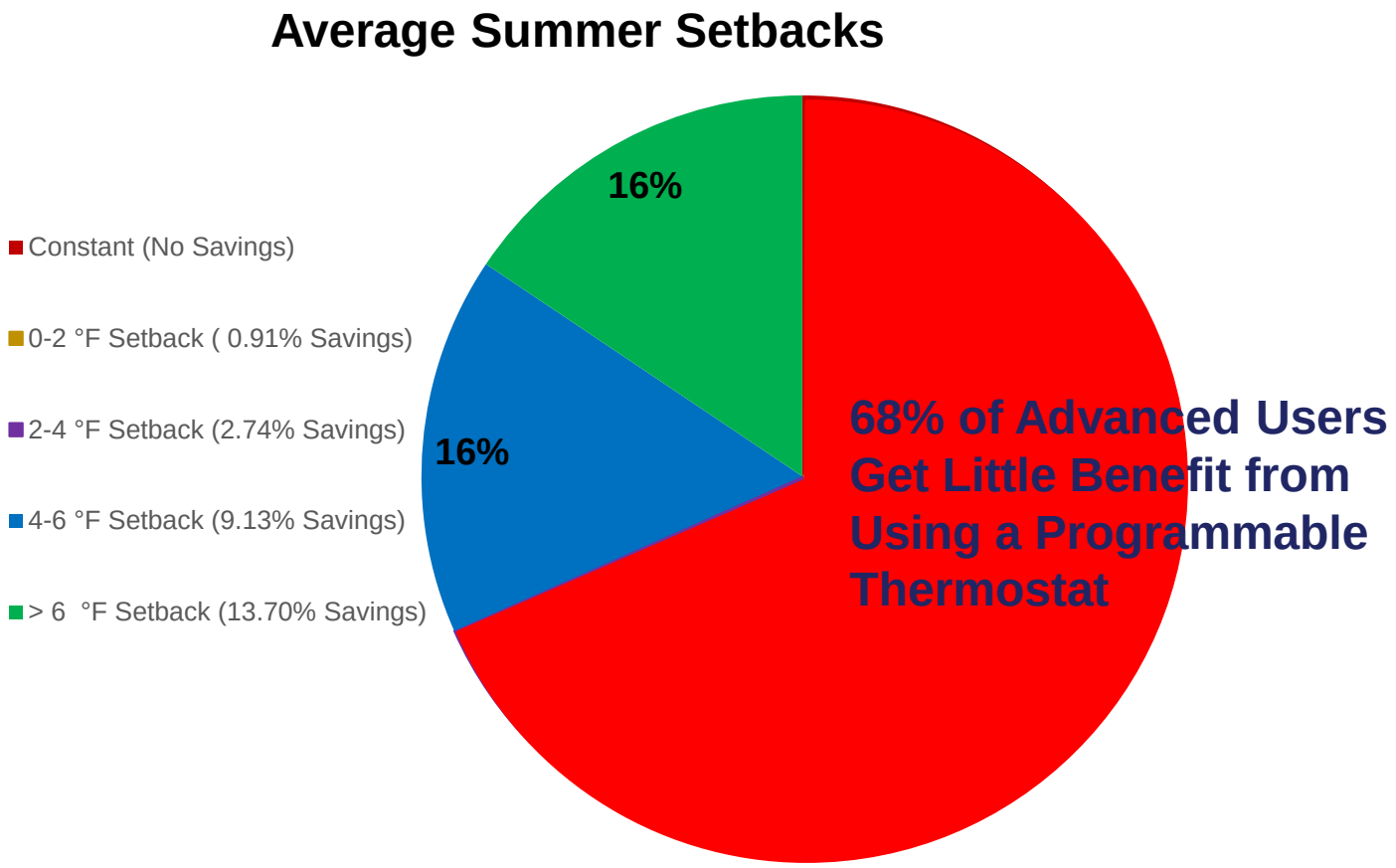
ALARM.COM

# The Programmable Thermostat Promise




Lot's Of Money to Be Saved, but…

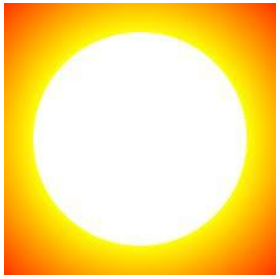
# Programmable Thermostat Challenges

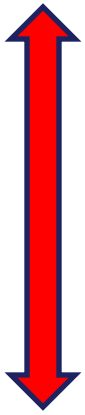



- The Above Results are Real Data from over 1,000 Consumers who are Early Adopters of Connected Programmable Thermostats

- The Reality is that the Average Set Back Falls Far Short of Recommendations

# Why Aren't Programmable Thermostats Being Used Effectively?

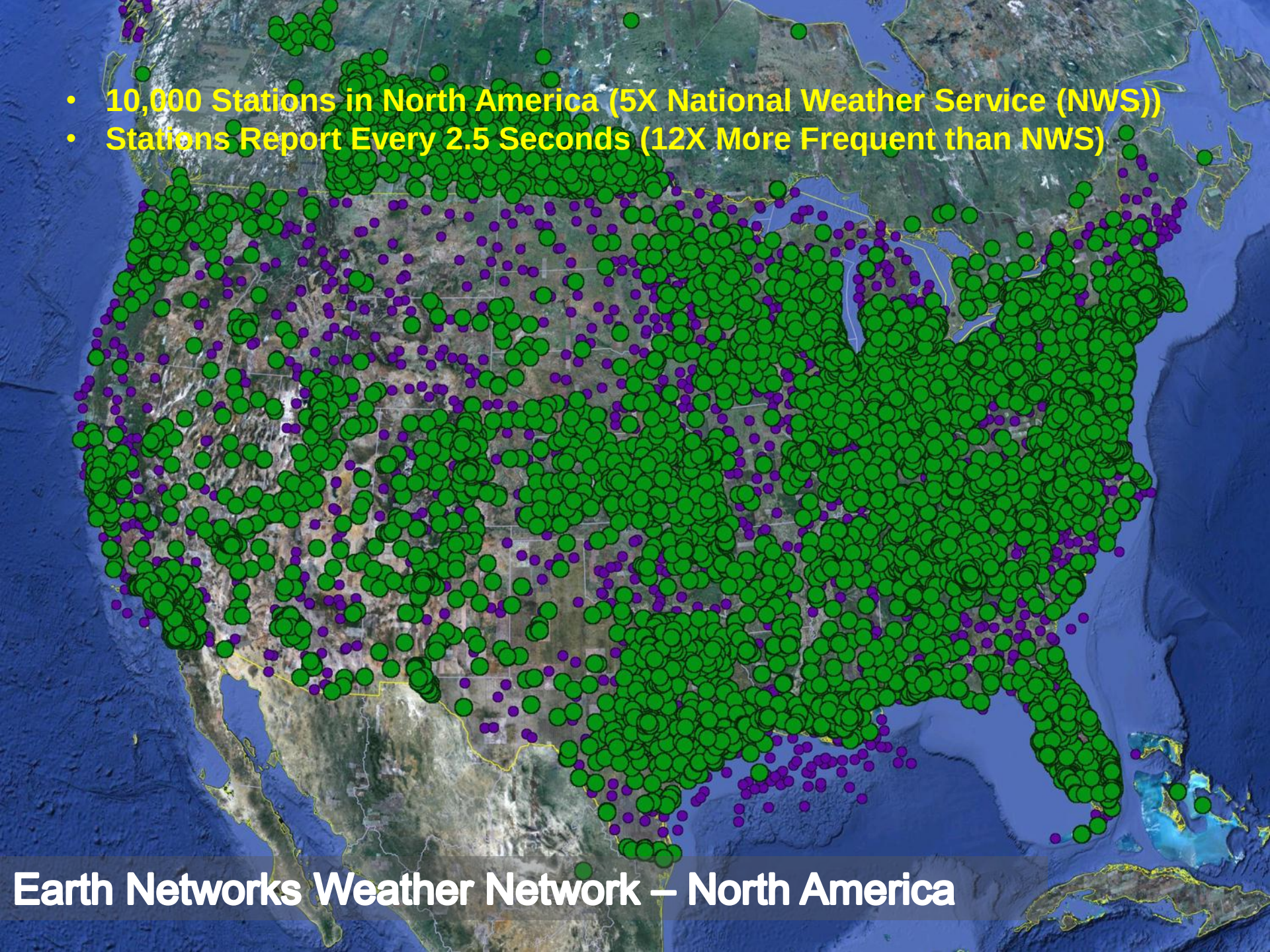




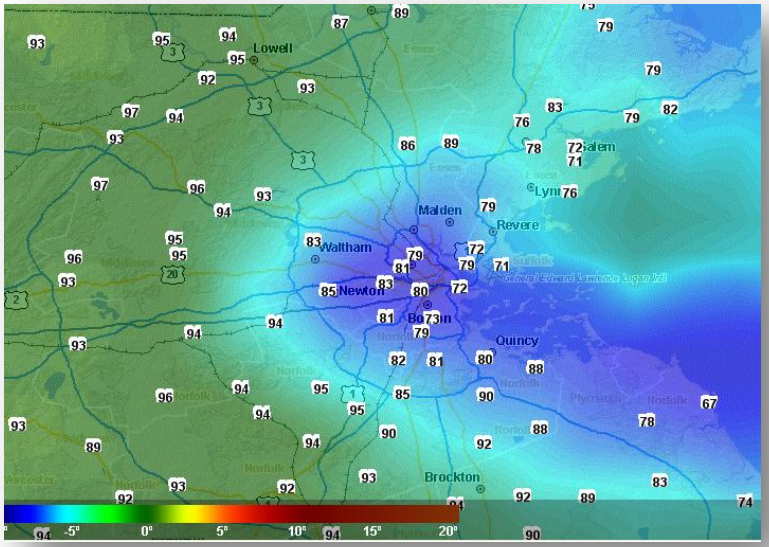
People Want Efficiency to the Extent it Doesn't Impact Comfort

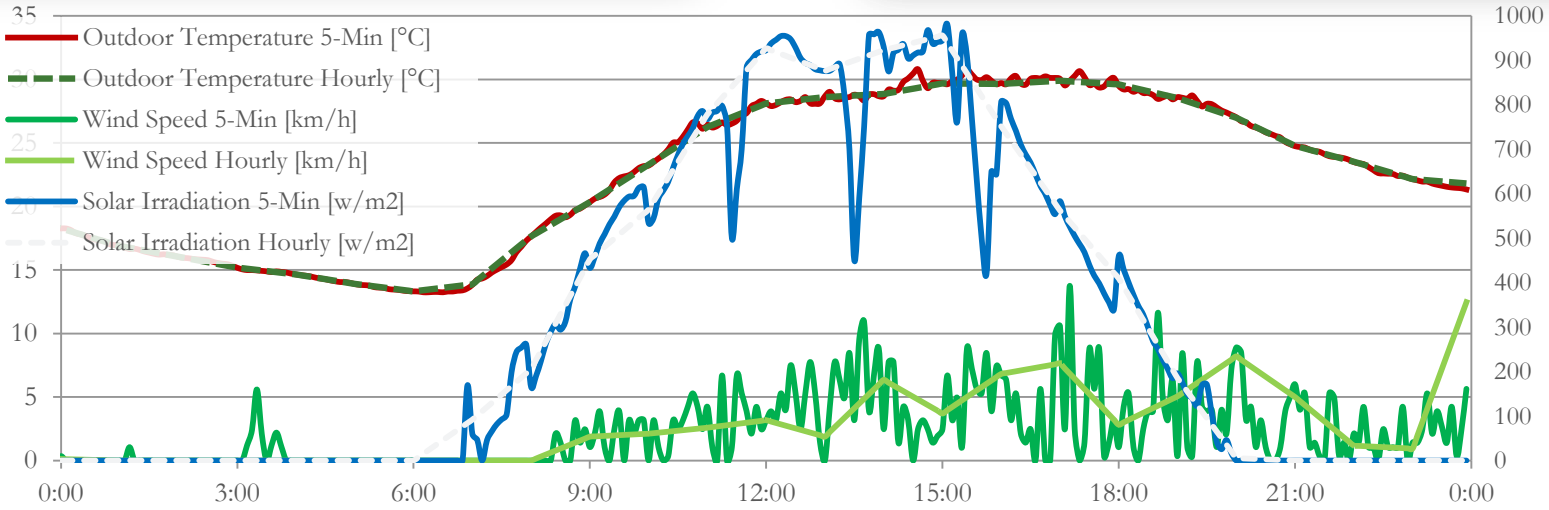
- Two Main Times when Consumers are Uncomfortable with Programmable Thermostats:
  - When Coming Out of Set Back in the Morning in the Winter
  - When Coming Out of Set Back in the Afternoon in the Summer
- If You can Ensure Comfort During these times, Your Chance for Real Energy Savings are Greatly Improved
- The Main Source of this Discomfort is the Variability of Weather and its Impact on Heating/Cooling Rates of Individual Houses

**e5 Can Help Solve This Problem!**


• 10,000 Stations in North America (5X National Weather Service (NWS))
• Stations Report Every 2.5 Seconds (12X More Frequent than NWS)
Earth Networks Weather Network – North America

# Hyper-Local Data Makes Grids Smarter




Hourly Weather Data (instead of 5-Minute) Results in 7.5 Hours of Error in Predicted AC runtime per Month

# e5 Energy Efficiency – 3 Techniques

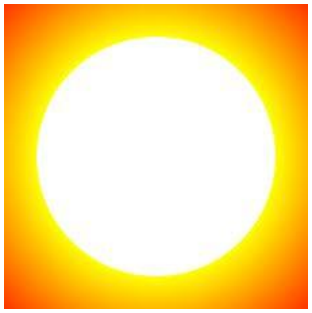
1. **Smart Setback**
   - By Hitting Critical Set-Points, e5 Users Can Use Larger Set Backs to Save More Energy

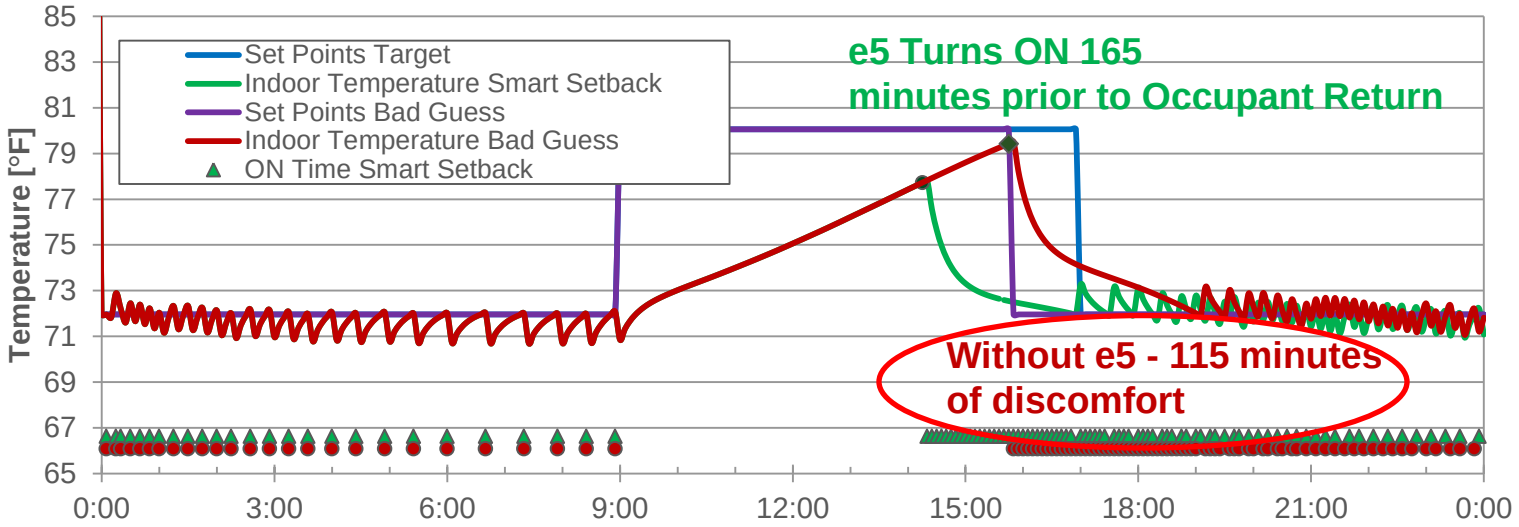
2. **Set Point Smoothing**
   - Energy can be Saved by Moving to the Next (Higher) Set Point Early
   - Savings are Only Achievable if this Does Not Result in More Use at Hotter Times of the Day

3. **Adaptive Pre-Cooling**
   - Running the Air Conditioner  at Lower Outside Air Temperatures is More Efficient
   - The Key is Understanding when this Efficiency is Not Lost by the House

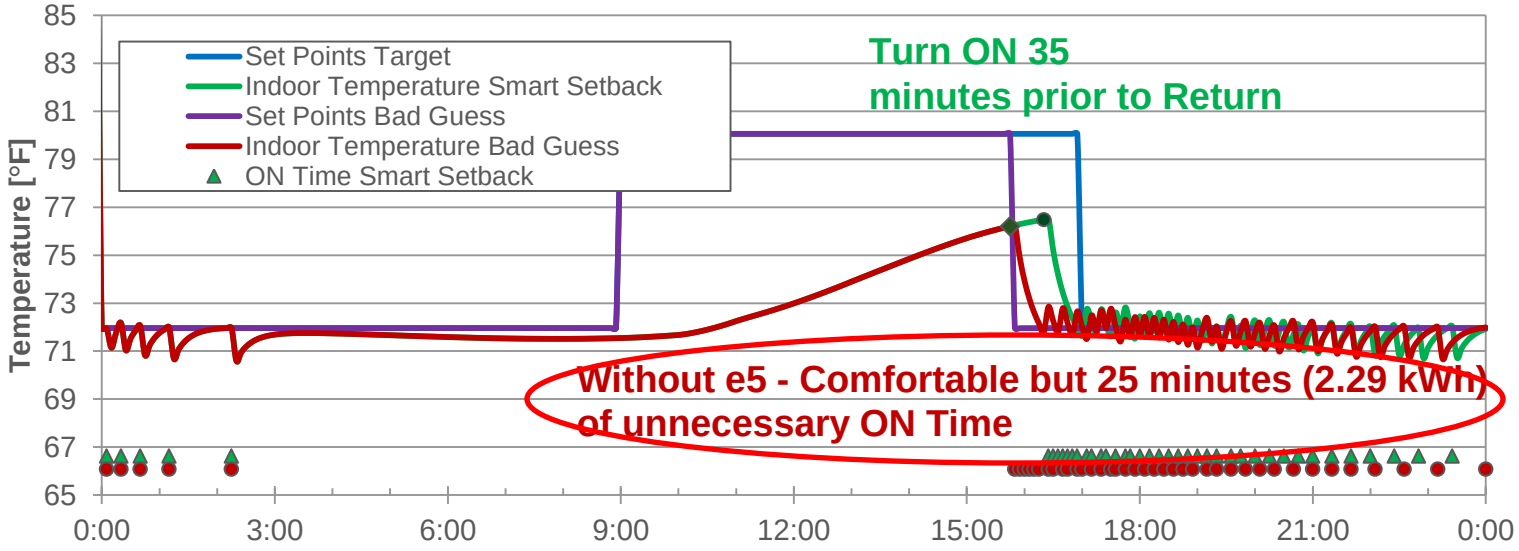
# e5 EE Technique #1: Smart Setback

On a Hot Day





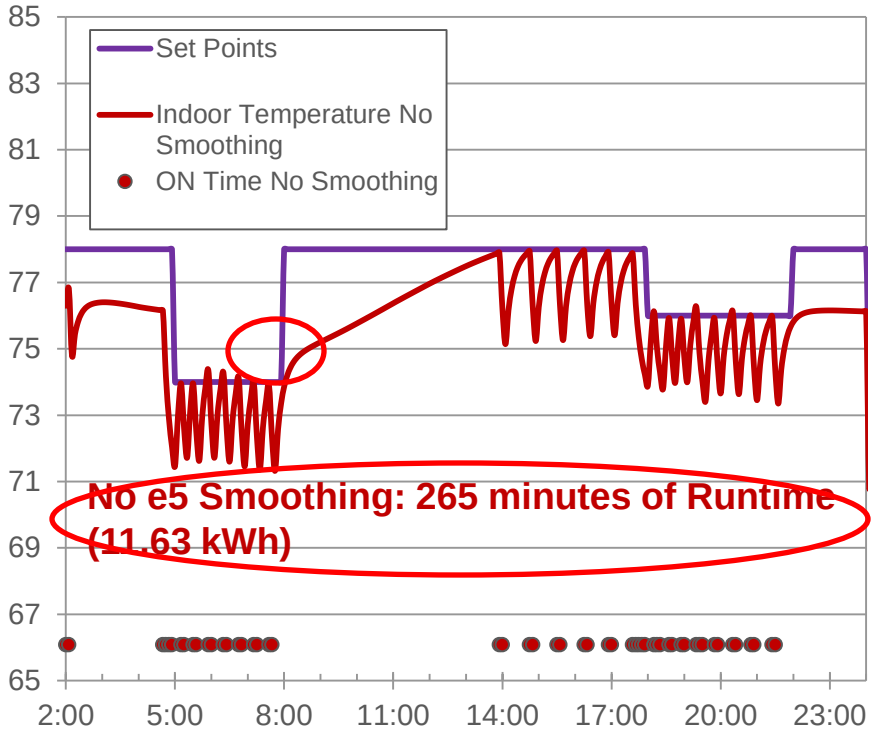

On a Cool Day

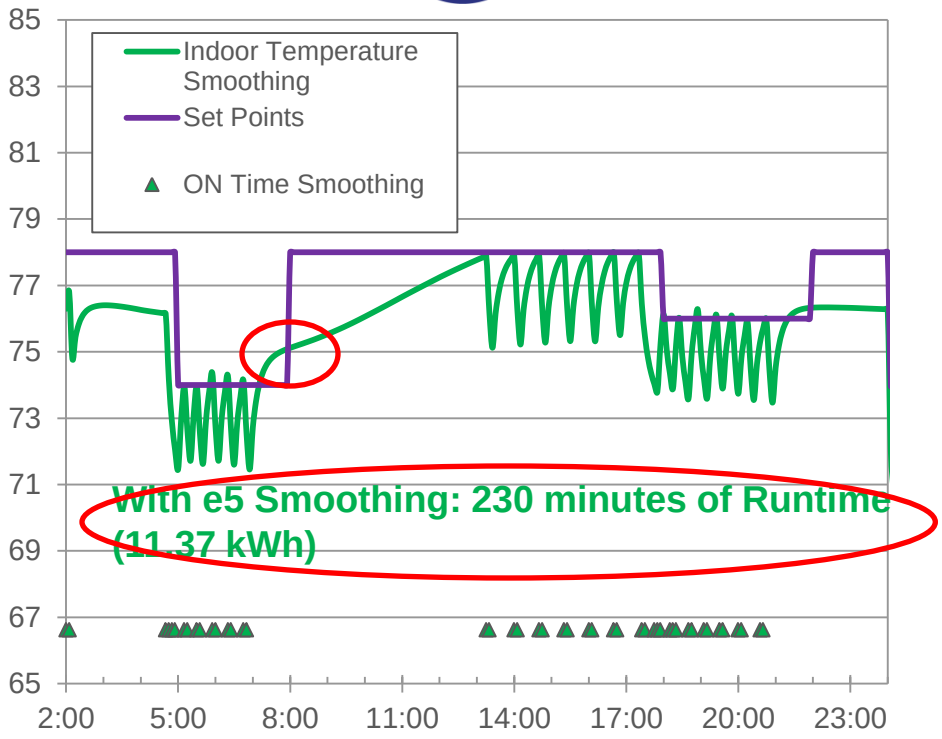



- ***Accounting for Weather's Impact on Heating and Cooling Allows e5 to Hit Critical Set Points***
- ***Without Weather Insight, Comfort AND Efficiency Cannot be Achieved***

# EE Technique #2: e5 Set Point Smoothing

## Standard Programmable Thermostat

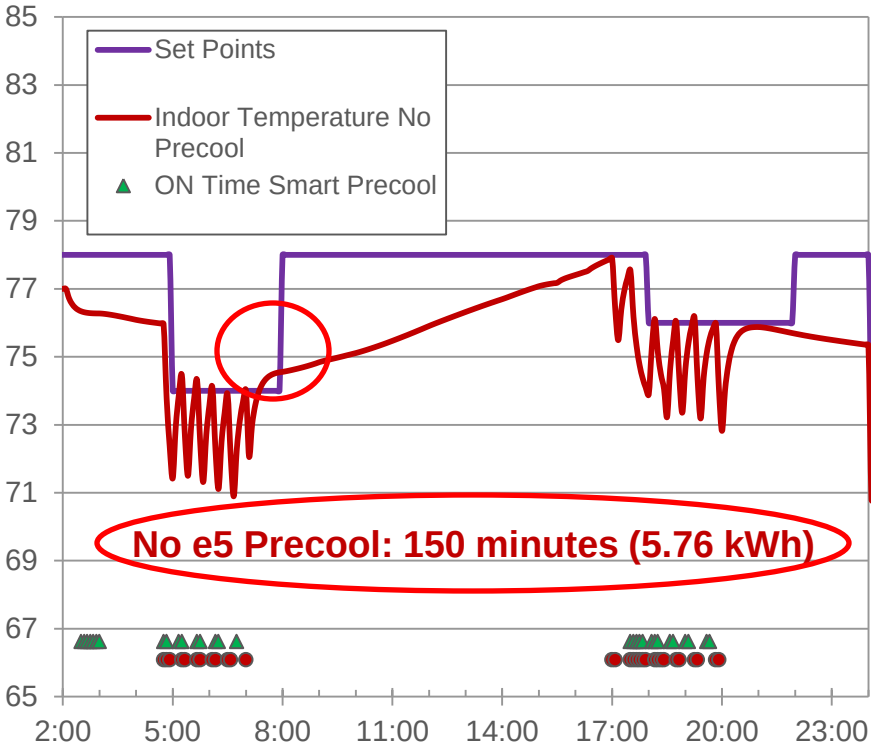


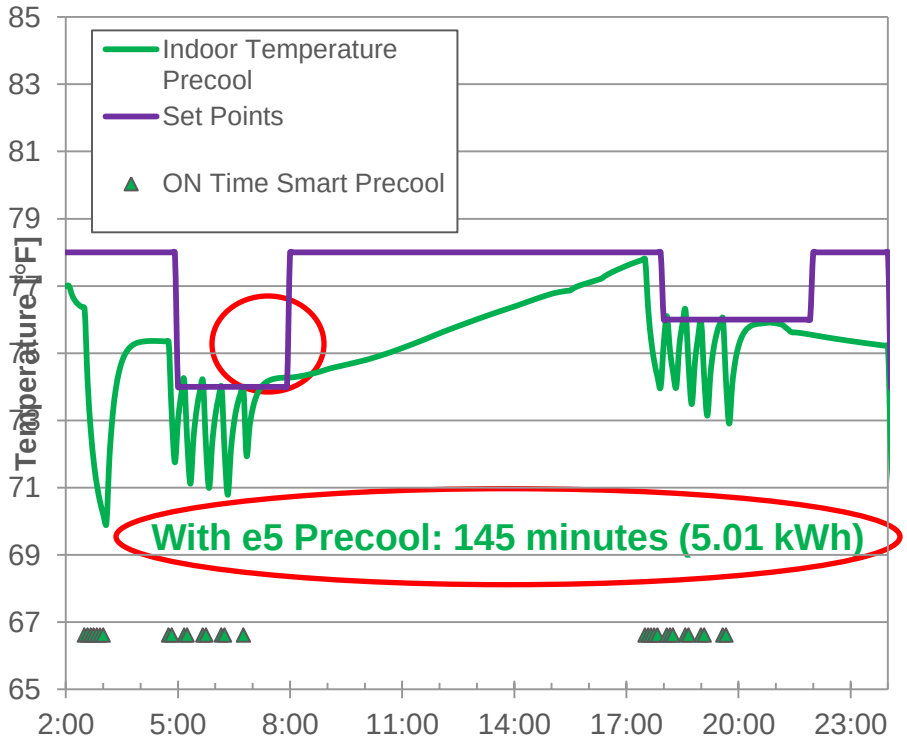




- ***Set Point Smoothing Works on 85% of Houses, and Saves Energy on 40% of Days***
- ***Achieving Automated Savings Requires an Understanding of the House, and Weather's Impact Upon It***

# EE Technique #3: e5 Pre-Cooling

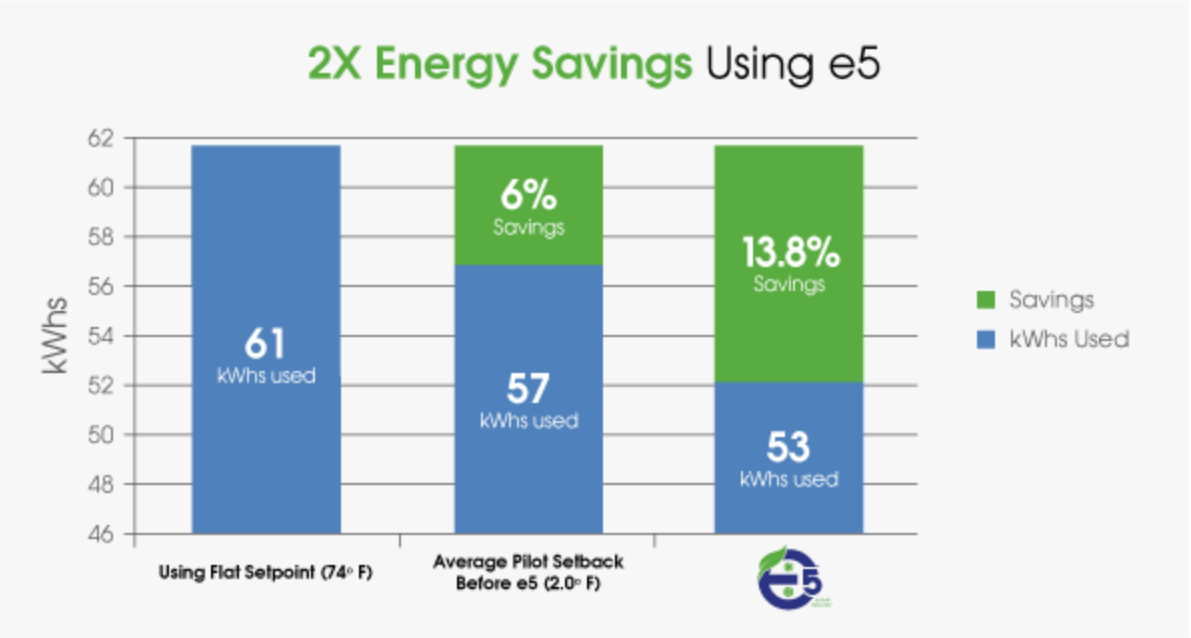
## Standard Programmable Thermostat

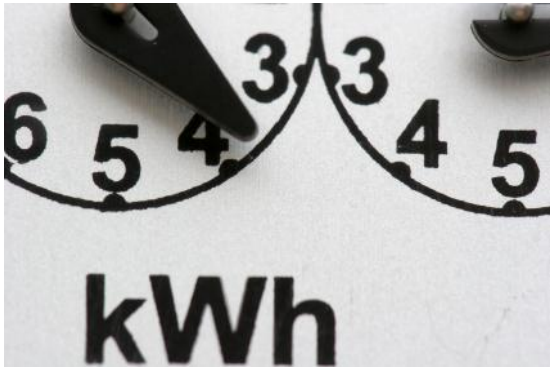



- ***Pre-Cooling Works on 30% of Houses, and Saves Energy on 17% of Days***
- ***Without Granular Data, the Odds Are Better that You Will Waste Energy by Pre-Cooling***

# Quantifying e5's Impact




**e5 Has the Potential to Save a Significant amount of Energy (13.8% on Average during the Cooling Season) with Little Impact to Consumer Comfort**

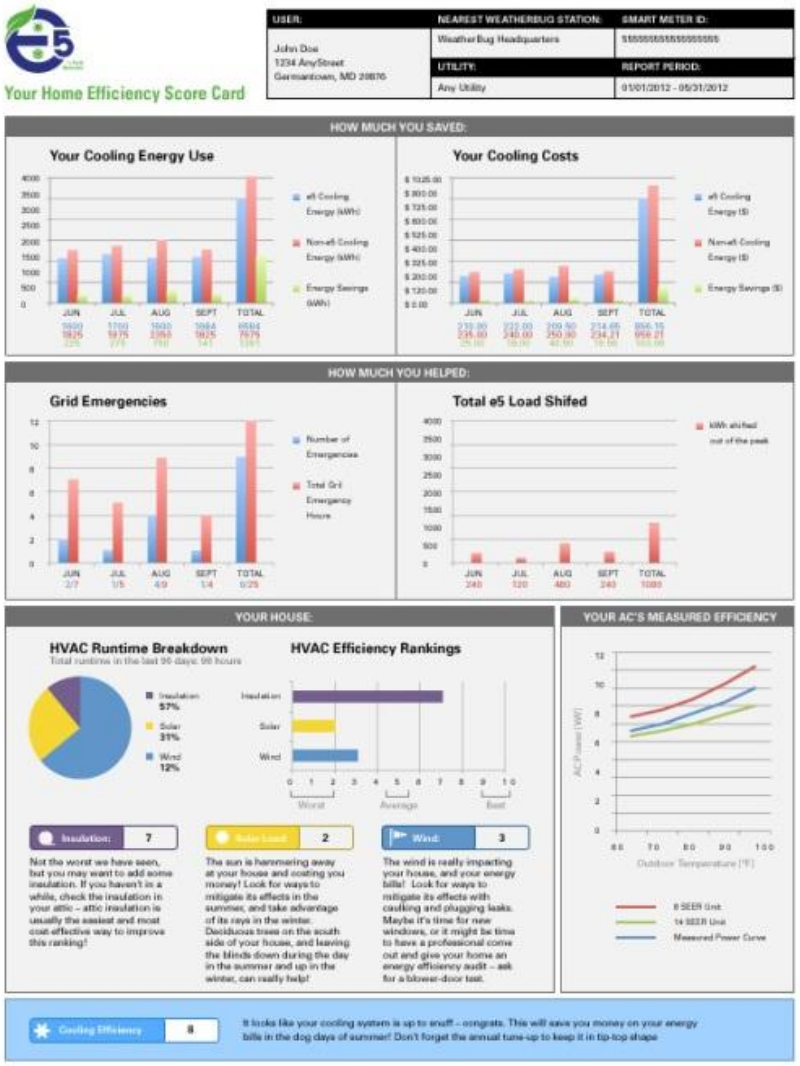
- 2X More Savings With e5 compared to Using Existing Average Set Backs (68% of Pilot Participants are Not Even Getting this Much Savings)
- Results Vary and are Dependent on the House, and Consumers Ability to Set Back
- Set Point Smoothing and Adaptive Pre-Cooling are Not Dependent on Consumer Behavior

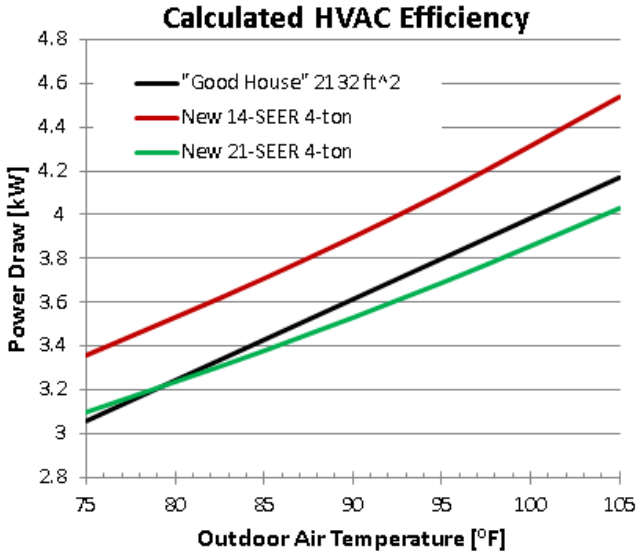
# e5 EE M&V Plan

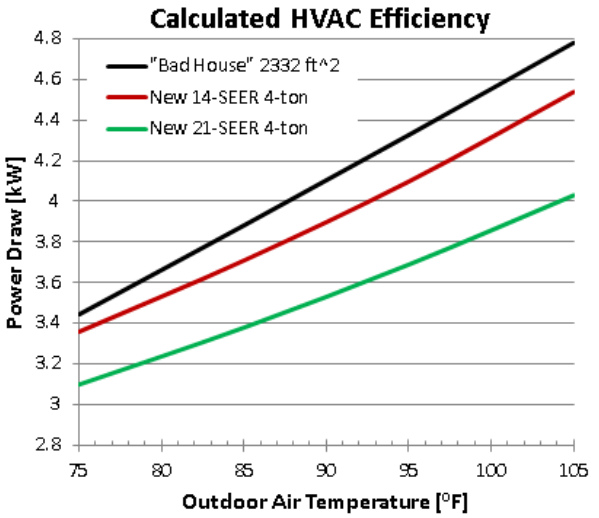
- Energy Efficiency Results to Date are Modeled across the 1,100 participant base, with real results from a small subset of that base
- Participant enrollment is open and growing
- Plan to Perform a Comprehensive Study on e5 EE results in the coming year
- All M&V performed Using Customer's Historical Data

# Home Efficiency Scorecard

An accurate house model allows e5 to provide insight for the consumer into their homes heating and cooling energy efficiency.



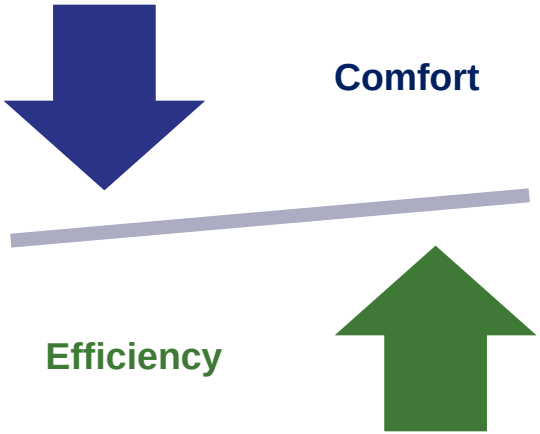



# e5 Demand Response

Legacy Demand Response Solutions Make Half-Hearted Attempts to Account for Participant Comfort and Lack the Insight to Predict Demand Response Capacity

- Each House Reacts Differently to Cycling or Temperature Off-Set
- This will Make an Unknown Group of Participants Unhappy with the Program




The Result:

- The Need to Over-Compensate for DR Capacity
- Higher Participant Churn
- No Predictive Capability of DR Capacity or Opt-Outs

# e5 Demand Response

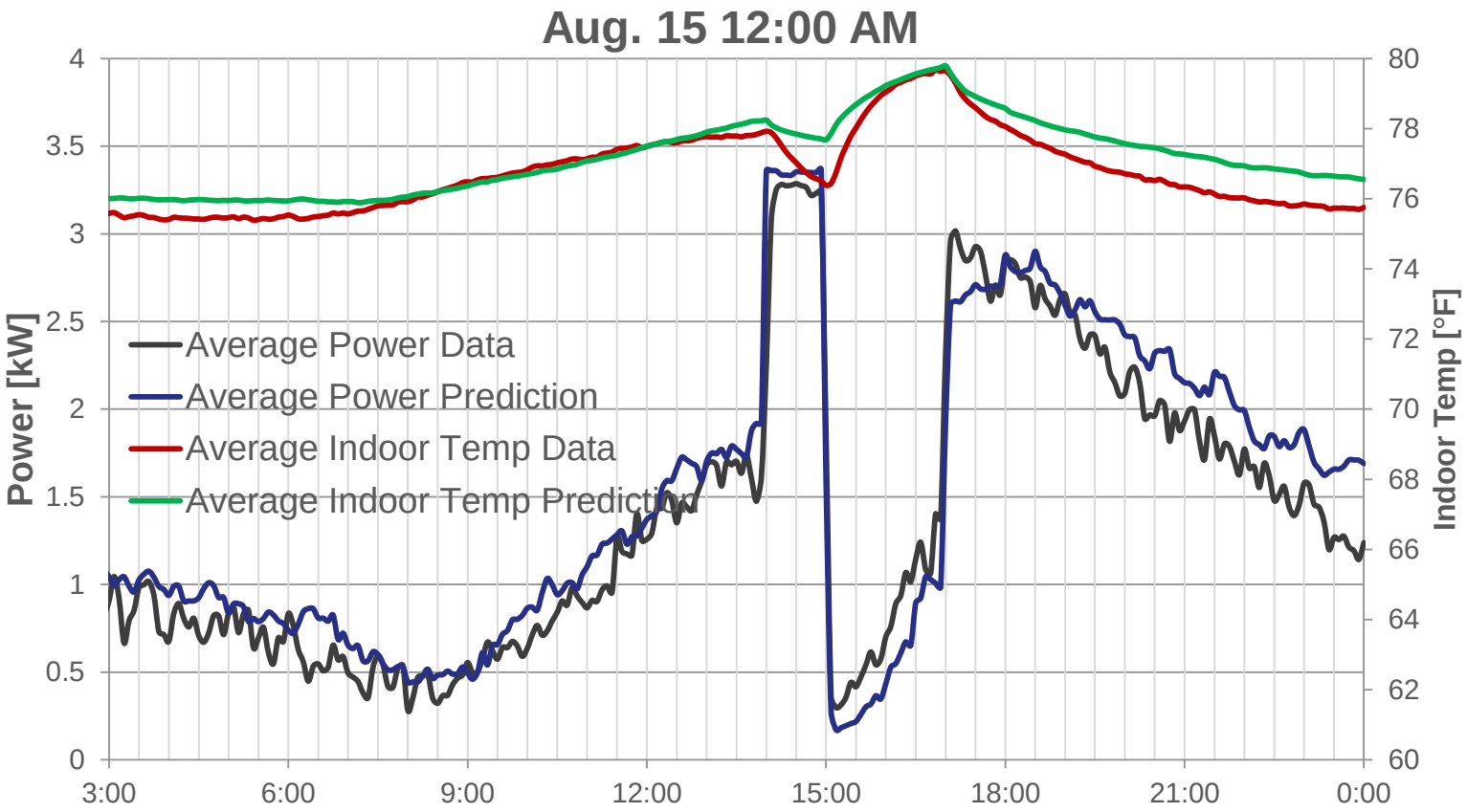
- e5 uses Individual House Models, Pre-Cooling, and Intelligent DR house rotation to Maintain Occupant Comfort during DR Events

- The Model Accuracy of e5 Allows it to Accurately predict DR Capacity and Indoor Temperatures prior to the Event

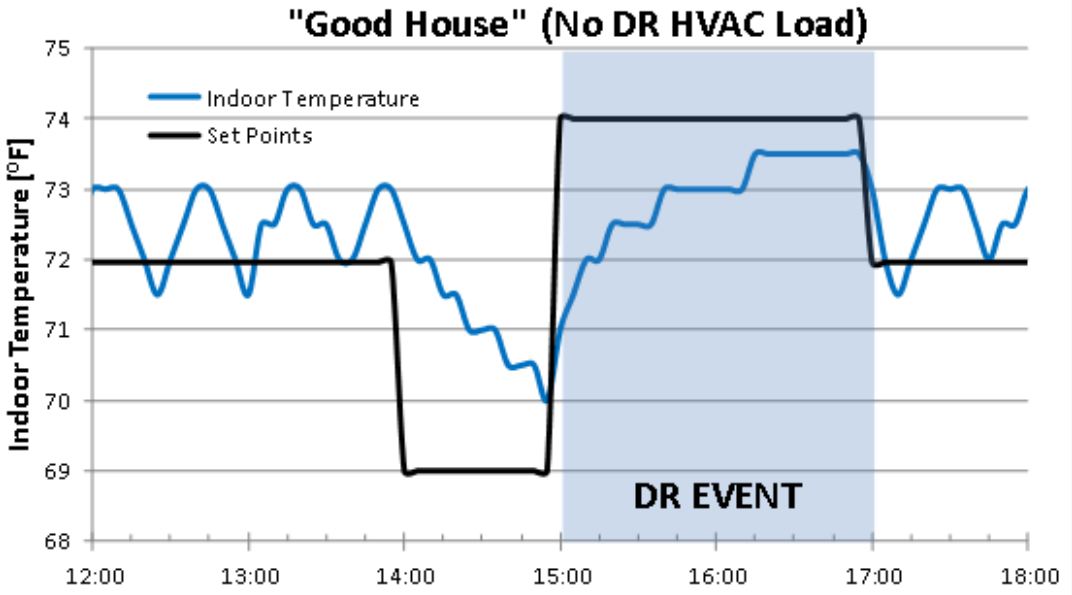
- e5 Compares Current Conditions to the Forecasts and Automatically Adjusts the Capacity Forecasts and Optimized Set Points

- Focus on Accuracy and Comfort provides Reliable DR Capacity with Lower Churn

# Demand Response Timeline

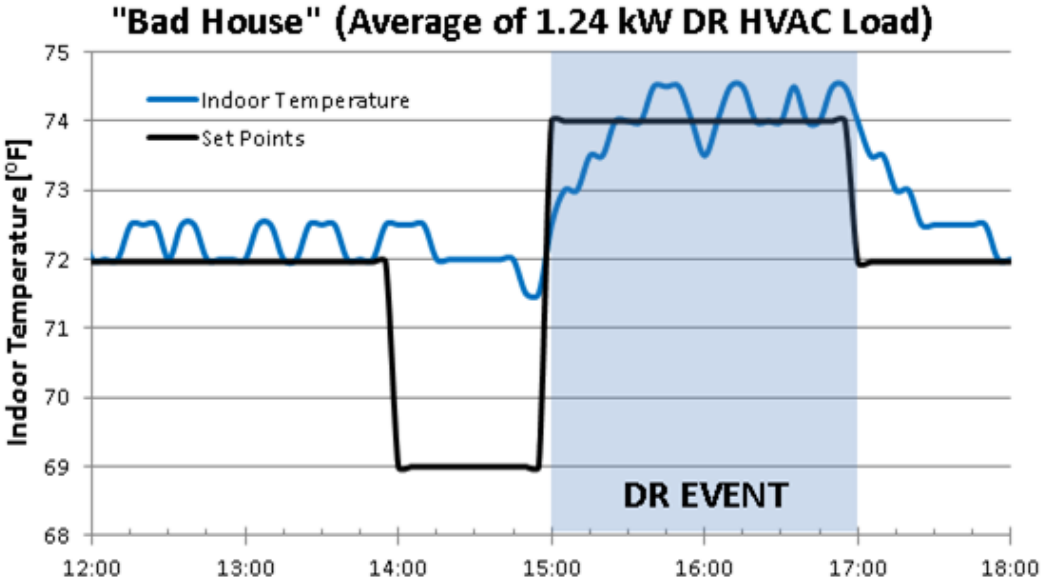


# Averages Are Great, But Every House is Unique

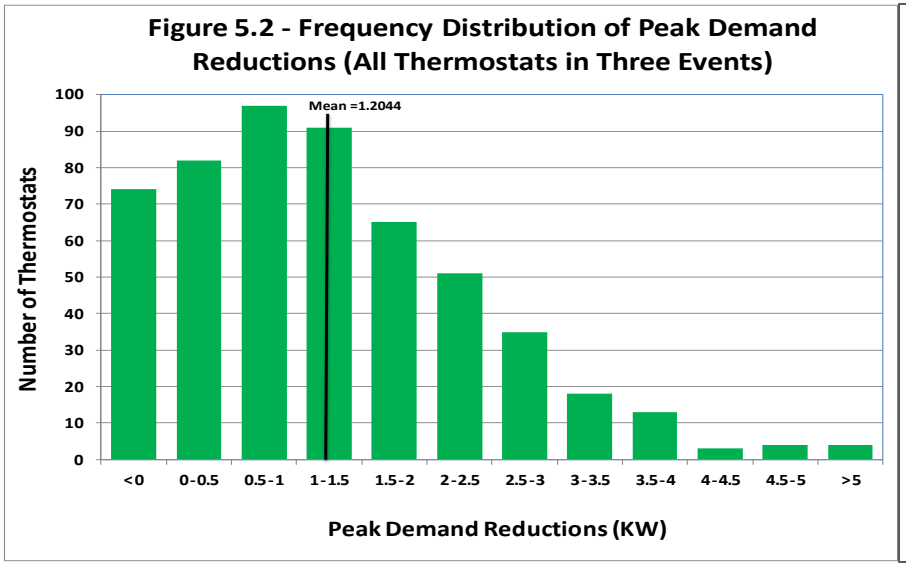


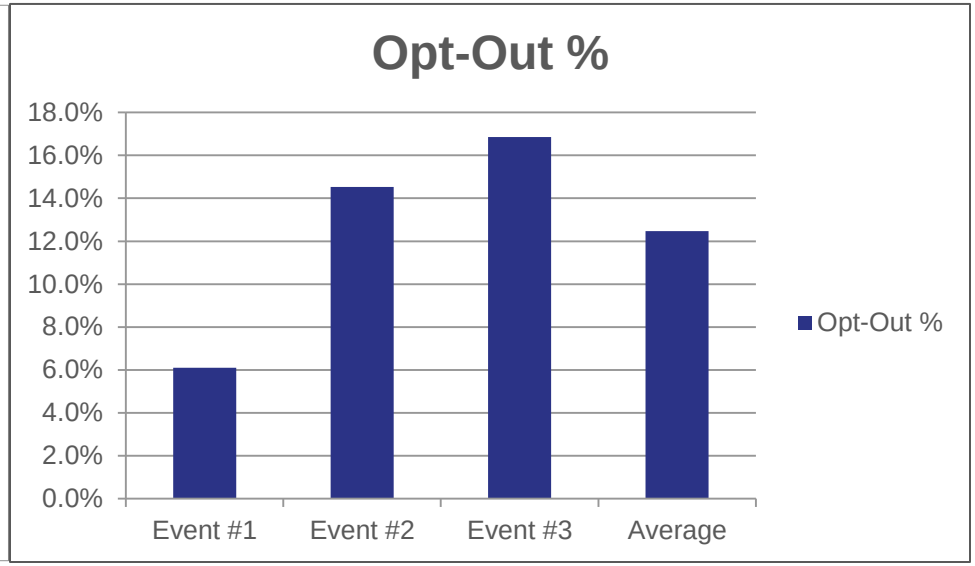

Through the use of Pre-Cooling, the Efficient House Made it all the Way Through the 2-hour DR with No Further Cooling Energy Applied. This resulted in an average of 2.87 kWh DR Capacity with a Minimal (0.5 Degree Above their dead-band) Impact on Occupant

The Inefficient House could not maintain the Pre-Cooling Temperature, so it lasted only 35 minutes of the 2-Hour DR, then began cycling again. This resulted and average of 1.89 kWh DR Load Shifted and in More Occupant Discomfort (we limited the temperature rise to 2 degrees)



# Demand Response Results




## Evaluated by a third party for verified results (EM&V):

537 Thermostats were tested in Three DR Events

- 1.2044 kW Mean (Estimated Average Deemed Savings)
- 1.0957 kW Median (the 50 percentile)
- 1.2434 kW Standard Deviation
- -2.5081 to 6.3272 kW Range
- Equivalent to Running the Pilot Air Conditioners at 25% Capacity

Pilot Participants Opted-Out at Low Rates

- 12.01 % Average
- Many Opted-Out During Pre-Cooling
- Participants Using “Holds” Negatively Impacted Opt-Out Results

# Summary

- Programmable Thermostats have Largely Failed to Deliver Customer Savings.
- e5 Engages with the Customer via the Internet, to Deliver both Customer Savings and Demand Response to the Utility or REP.
- Real-Time Weather and Other Data Provides the Opportunity to Move to Algorithmically Controlled Thermostats that Do Not Sacrifice Comfort to Gain Efficiency and Demand Response Capacity – Integrated Demand Side Management.
- e5's Pilot Energy Efficiency Results showed 2X Gain in Energy Efficiency over Using a Programmable Thermostat alone and - with Proper Education - More Energy Savings are Achievable.
- Our Demand Response Pilot with Centerpoint Energy Produced Impressive Results (1.2 kW per Thermostat Sustained) with Low Consumer Discomfort.

# Next Steps

In 2013 We Plan to:

- Verify the e5 EE savings across the Base
- Grow the Base with Additional Thermostat and Service Provider Relationships
- We are Actively Looking for Additional Utility or REP Partners in Texas to Provide the EE and DR Benefits of e5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